FREE NOTES · NCERT + NEET LEVEL

Sexual Reproduction in Flowering Plants

Flower reproduction ki jagah, stamen aur microsporogenesis, pollen grain, pistil aur megasporogenesis, embryo sac, pollination, pollen–pistil interaction, double fertilisation, fertilisation ke baad ki ghatnayein, apomixis aur polyembryony.

01 Flower aur stamen
02 Pollen grain
03 Pistil aur embryo sac
04 Pollination
05 Pollen–pistil interaction aur fertilisation
06 Fertilisation ke baad
07 Extra + tricks
08 Important Q&A
09 Common mistakes
10 Practice (NEET style)
11 Quick revision

01 Flower aur stamen

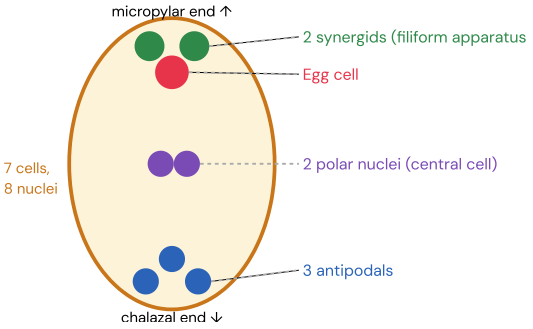
- Flower = sexual reproduction ki jagah; androecium (stamens: male), gynoecium (pistil: female).
- Stamen: filament + anther. Aam anther **bilobed**, har lobe me 2 theca (dithecous) ⇒ **tetragonal**, 4 microsporangia (pollen sacs).
- Microsporangium ki layers (bahar → andar): epidermis, endothecium, middle layers, **tapetum** (badhte pollen ko poshan; cells aksar multinucleate, ghana cytoplasm).
- Sporogenous tissue: har **pollen mother cell** (PMC, 2n) meiosis ⇒ **microspore tetrad**: **microsporogenesis**.

02 Pollen grain

- Do layer wali wall: **exine sporopollenin** ki (sabse mazboot organic padarth; garmi, tez acid, alkali sah leta; koi enzyme nahi todta), **germ pores** (sporopollenin nahi); **intine** cellulose aur pectin ki.
- Paka pollen: **vegetative cell** (bada, khana store, bada tedha nucleus) aur **generative cell** (chhota, spindle, vegetative cell me tairta; 2 male gametes banata).
- 60% se zyada angiosperms me 2-celled stage pe girta, baaki me 3-celled.
- Viability: chawal, gehun ~30 min; Rosaceae, Leguminosae, Solanaceae: mahine. Pollen banks me liquid nitrogen (-196 °C). Pollen allergy (*Parthenium*/carrot grass); pollen tablets supplement.

03 Pistil aur embryo sac

- Pistil: stigma (pollen utarne ki jagah), style, ovary jisme placenta pe ovules (megasporangia). Monocarpellary ya multicarpellary (syncarpous / apocarpous).
- Ovule: funicle, hilum, 1–2 integuments, micropyle, chalaza, **nucellus** (khana).
- **Megasporogenesis**: micropylar taraf megaspore mother cell (MMC) meiosis ⇒ 4 megaspores; aam taur pe 3 khatam.
- **Monosporic**: functional megaspore ka nucleus 3 baar mitosis ⇒ 8 nuclei (pehle free nuclear, phir walls) ⇒ **7-cell, 8-nucleus embryo sac** (female gametophyte). Egg apparatus = egg + 2 synergids.



Paka embryo sac

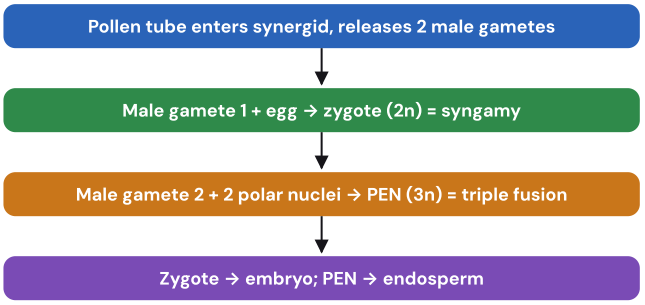
04 Pollination

Type	Matlab	Notes
Autogamy	Usi flower me	Chasmogamous (khule) flowers; **cleistogamous** (kabhi nahi khulte: *Viola*, *Oxalis*, *Commelina*) seed pakka
Geitonogamy	Usi plant ka doosra flower	Kaam me cross, genetically autogamy jaisa
Xenogamy	Doosra plant	Genetically alag pollen

- Agents: hawa (halke, chipchipe nahi; bahar nikle stamens; bada pankh jaisa stigma; ek ovule; ghaas, makke ki tassels), paani (*Vallisneria*, *Hydrilla*, *Zostera* (samundari); mucilage wale pollen), jaanwar (sabse zyada madhumakkhi; bade rangeen khushbudaar nectar wale flowers; *Amorphophallus* sabse ooncha flower; yucca–moth).
- Outbreeding devices: pollen girna aur stigma taiyaar hona alag samay; anther aur stigma alag jagah; **self-incompatibility**; unisexual flowers (arandi, makka monoecious; papita dioecious).

05 Pollen–pistil interaction aur fertilisation

- Pistil sahi pollen pehchaanta (chemical baat-cheet); galat pollen reject.
- Sahi pollen ugta; pollen tube stigma aur style se, micropyle se ovule me, **filiform apparatus** ke sahare synergid me.
- **Artificial hybridisation**: emasculation (anthers phatne se pehle hataana) + **bagging** (butter paper) ⇒ chaha pollen daalna ⇒ phir bag. Unisexual female flowers me emasculation nahi.
- **Double fertilisation** (sirf angiosperms) = syngamy + triple fusion.



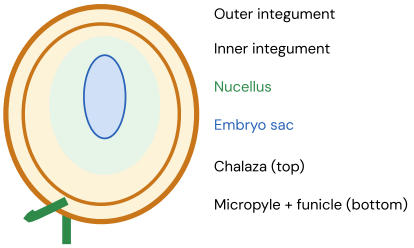
Double fertilisation

06 Fertilisation ke baad

- **Endosperm** embryo se pehle banta. Free-nuclear endosperm (nariyal paani = free nuclear; safed giri = cellular). Non-albuminous seeds (matar, moongphali, sem: endosperm khatam); albuminous seeds (gehun, makka, jau, arandi, sunflower). **Perisperm** = bacha nucellus (kaali mirch, chukandar).
- **Embryo** micropylar end pe: proembryo → globular → heart-shaped → mature. Dicot: embryonal axis, 2 cotyledons, epicotyl (plumule), hypocotyl (radicle). Monocot (ghaas): ek cotyledon = **scutellum**; coleoptile, coleorhiza.
- Ovule → seed (integuments → testa, tegmen); ovary → fruit (wall → pericarp). **False fruits**: thalamus bhi fruit banata (seb, strawberry, kaju). Parthenocarpic (kela) bina fertilisation. Beej bahut der tak zinda: lupine 10,000 saal; khajoor ~2000 saal.
- **Apomixis**: bina fertilisation beej (Asteraceae, ghaas); hybrid vigour bachane me upyogi. **Polyembryony**: ek se zyada embryo (citrus, aam; nucellar cells se).

07 Extra + tricks

- Sabse aam ovule: **anatropous** (ulta; micropyle funicle ke paas). Orthotropous: seedha (*Polygonum*).
- **Parthenocarpy**: bina fertilisation phal (kela); auxins/GA se bhi.
- Beej ka mahatva: dormancy se kathin samay me zinda; nayi jagah failna; ankur ke liye khana; sexual prajanan se genetic variation.
- Ploidy trick: **"endosperm 3, embryo 2, gametes 1"**; nucellus aur integuments 2n (maa ke).
- Pollen viability: anaaj ~30 min; pollen banks me liquid N_2 (-196 °C).



Anatropous ovule (saral)

08 Important Q&A

Q1. Sporopollenin kyun zaroori?

Exine ko bahut mazboot banata, pollen kathin halaat sahta aur fossils me bachta.

Q2. Ploidy: PMC, microspore, nucellus, endosperm, synergid.

2n, n, 2n, 3n, n.

Q3. Cleistogamous flowers hamesha autogamous kyun?

Kabhi khulte nahi, sirf apna pollen stigma tak pahunchta.

09 Common mistakes

- Embryo sac me 8 cells kehna (7 cells, 8 nuclei).
- Geitonogamy ko genetically cross kehna.
- Perisperm ko triploid likhna (nucellus, 2n).
- Bhoolna ki unisexual female flowers me emasculation nahi chahiye.

10 Practice (NEET style)

1. Pollen ko poshan dene wali layer?
2. Paani se pollinated samundari plant?
3. Nariyal paani ka endosperm?
4. Pollen tube ko synergid me le jaata?
5. Bina fertilisation beej?

ANSWERS

1) Tapetum · 2) *Zostera* · 3) Free nuclear · 4) Filiform apparatus · 5) Apomixis

11 Quick revision: exam se 5 minute pehle

MALE

- Anther tetrasporangiate
- Tapetum poshan
- Exine sporopollenin

FEMALE

- Monosporic
- 7 cells, 8 nuclei
- Egg + 2 synergids

POLLINATION

- Cleistogamy: Viola, Oxalis
- Vallisneria paani
- Emasculation + bagging

AFTER

- Syngamy + triple fusion
- Endosperm 3n pehle
- Apomixis, polyembryony

Koi doubt? padhaiadda.netlify.app pe AI Doubt Solver se poocho, ya is chapter ka mock test do.